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### (54) Coating composition for use in an ink-jet ink-receptor sheet

(57) The invention relates to a coating composition. This coating composition may be used to coat a surface, preferably at least one surface of a recording sheet, in particular a recording cellulosic or paper sheet, comprising a binder and pigment, characterized in that said pigment comprises a mixture, in weight ratio, of from about 40-60% Kaolin clay and 60-40% calcined

clay.

The preferred pigment component is a 50/50 weight mixture of Kaolin clay and calcined clay and the preferred binder component is polyvinyl acetate.

The invention coating composition has been found to possess a high absorption capacity for the vehicle of an inkjet ink and good compatibility with ink receptive top coating applied over the base coat.

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## Description

[0001] The present invention relates generally to a coating composition usable to coat a surface, a base coated recording sheet, notably for ink-jet recording, said recording sheet being preferably a paper recording sheet.

## Background of the Invention

[0002] Conventional inkjet recording sheets are prepared by coating a paper surface with a coating composition containing a porous fine pigment in a binder capable of accepting and retaining the ink on the surface of the paper, while the paper absorbs the ink vehicle. However, in some instances the paper is unable to instantaneously absorb the entire amount of the ink vehicle. This drawback often results in spreading of the ink drops, which creates resolution and sharpness defects, and unduly long drying times.

[0003] It is known that inkjet recording paper may be improved by first applying a suitable base coat having good absorption characteristics to the paper, before applying the ink receptive top coat. Such base coatings must possess a balance between good coating holdout and adequate water absorbency. It has also been discovered that such basecoats must be compatible with the subsequently applied ink receptive top coatings for good runnability and performance during manufacture.

[0004] Substrates for inkjet recording sheets must rapidly absorb the vehicle of the inks to reduce drying time with little or no backside show-through. Further, the substrate plays a role in preventing diffusion of ink laterally on the surface of the recording sheet in order to achieve high resolution without blurring. Thus, for obtaining color images having good color density and resolution, with good absorptivity and water fastness as well as optical brightness, the substrate plays an important role. Paper substrates for ink receptive coatings are generally made from bleached chemical pulp to which fillers, dyes, and if required, sizing agents and strength enhancers are added. An example of a typical paper substrate for use in the manufacture of an inkjet recording sheet is disclosed in pending United States patent application S.N. 09/020,826 filed February 9, 1998, owned by the present assignee herein.

[0005] It is also known that paper substrates for inkjet recording can be improved by applying a basecoat to the paper before applying the ink respective top coating. Such base coats generally comprise a pigment and binder to provide a surface having a porous structure which has good absorptivity for the ink vehicle. Examples of base coatings for inkjet recording sheets are disclosed, for example, in prior United States patents Nos. 4,474,847; 5,171,626; 5,670,242; 5,747,148; and 5,759,673. In particular, the '242 patent discloses typical examples of the materials useful for the base coatings of inkjet recording sheets to include various known pig-

ments used in ordinary coated papers, such as kaolin clay, calcined clay, amorphous silica, zinc oxide, aluminum oxide, aluminum hydroxide, calcium carbonate, satin white, aluminum silicate, smectite, magnesium silicate, magnesium carbonate, magnesium oxide and others. However, in practice, the most often used pigments for such basecoats comprise clay, calcium carbonate, amorphous silica and aluminum oxide. Another requirement of the basecoat is that the coating components not interfere in any way with the top coatings which provide the ink receptive surface for such products. Where adverse reactions occur, the base coat components must be changed or altered.

## Summary of Invention

[0006] In the aforementioned pending United States patent application S.N. 09/020,826, a base coating is disclosed which comprises as the coating pigment precipitated calcium carbonate, calcined clay, and, if desired, titanium dioxide. Polyvinyl acetate is disclosed as the preferred binder. This base coating has been found to be compatible with most top coatings, and when combined with a top coating containing fumed silica, achieved satisfactory printing results with regard to ink bleed, drying time and gamut characteristics. However, the same base coating produced undesirable interactions when used with other top coatings. It was observed that the precipitated calcium carbonate in the above described base coating had a tendency to destabilize top coatings which were acidic in nature. Thus to overcome this interaction, and to provide a more universally acceptable base coating, the pigment combination disclosed herein was adopted. By substituting a kaolin clay based pigment in place of the precipitated calcium carbonate pigment utilized in the above described base coating and increasing the calcined clay content, the destabilization mentioned above with the use of acidic top coatings was averted while still achieving the desired ink-jet printing characteristics.

[0007] Thus while it was heretofore known that the selection of a suitable base coating is necessary to obtain proper inter color bleed, gamut and ink drying time of the final sheet, it has now been found by the present invention that the proper selection of the base coating components is also necessary to prevent any undesirable interactions between the base coating and the top coating during the manufacturing process.

[0008] It is, therefore, a general object of the present invention to provide a coating composition which may be used to coat a surface having superior performance for coating said surface and preferably at least one surface of a recording sheet, in particular a recording cellulosic, more particularly paper, sheet.

[0009] It is a further object of the invention to provide use of a coating composition for coating a surface, preferably at least one surface of recording sheet, advantageously of cellulosic, more particularly paper, recording

sheet, in one or more coating layers, advantageously to form at least a base coat, having such a superior performance of coating, and notably for inkjet printing for example of inkjet recording sheets.

[0010] It is a further object to provide a coating composition which constitutes a base coating for a surface and notably a substrate, preferably a recording sheet, in particular a recording cellulosic, more particularly paper, sheet, which has excellent dimensional stability and notably and preferably when used with aqueous based coating compositions which may be aqueous based inks.

[0011] A further object of the present invention is to provide a coating composition for a substrate useful in the manufacture of inkjet recording sheets, preferably inkjet recording cellulosic or paper sheets, that has little or no adverse interaction with the top coatings applied thereto.

### Detailed description

[0012] According to a first aspect, the invention relates to a coating composition which may be used to coat a surface, preferably at least one surface of a recording sheet, in particular a recording cellulosic or paper sheet, comprising a binder and pigment, characterized in that said pigment comprises a mixture in weight ratio, of from about 40-60% Kaolin clay and 60-40% calcined clay.

[0013] Advantageously, said pigment is consisting essentially of, or is made only of, the mixture, in weight ratio, of from about 40-60% Kaolin clay and 60-40% calcined clay.

[0014] According to a particular embodiment, each of Kaolin clay and calcined clay has an average particle size in the range of from about 0.00495-0.00594 mm (0.5-0.6 micro-meter).

[0015] According to another particular embodiment, said coating composition comprises a solvent, preferably water thereby being an aqueous coating composition.

[0016] According to another particularly advantageous embodiment, said solvent, preferably water, is present in an amount sufficient to provide a coating composition with a solid content of less than about 60% and preferably from about 45 to 60% and advantageously; said coating composition having a viscosity of from about 1500-2000 mPas (1500-2000 cps Brookfield, No.2 spindle).

[0017] In a most preferred embodiment, the weight ratio of Kaolin clay to calcined clay is about 50/50.

[0018] According to another particular embodiment, the binder comprises polyvinyl acetate.

[0019] According to a second aspect, the present invention relates to the use of the coating composition as defined above or as resulting from the following specification, taken as a whole, for coating a surface, preferably at least one surface of a recording sheet, advantageously

of a cellulosic, in particular paper, recording sheet, in one or more coating layers, advantageously to form at least a base coat. The performing of such a coating in one or more coating layers is familiar to one skilled in the recording art.

[0020] Advantageously, the use of the coating composition is for forming a base coat of an ink-jet recording sheet, preferably an ink-jet recording cellulosic in particular paper, sheet comprising a size pressed paper rawstock.

[0021] According to a third aspect, the present dimension further relates to a base coated recording sheet, preferably a base coated cellulosic, in particular paper, recording sheet notably for ink-jet recording, having applied to at least one surface thereof the dried residue of from about 2.72 to 4.54 kg/278.7 m<sup>2</sup> (6-10 lbs/ream, ream size 3300ft<sup>2</sup>) of the invention coating composition as defined here above or as resulting from the following specification, preferably an aqueous coating composition.

[0022] According to an advantageous embodiment, the coated recording sheet has a dried residue of said coating composition providing a Gurley porosity of said recording sheet of from about 200-800 sec/50 cc.

[0023] It results from the above that the base coated substrate of the present invention achieves enhanced properties vis-à-vis inkjet printing performance as a result of a combination of rawstock properties and base coating. The substrate is preferably alkaline paper having a basis weight in the range of from about 100-150 g/m<sup>2</sup> and a caliper of about 0.127 mm (5.0 mil). The substrate is prepared from a bleached chemical wood pulp furnish to which there is added a sizing agent such as alkylketene dimer, and fillers such as precipitated calcium carbonate and kaolin clay. The substrate is further preferably size pressed with a mixture of starch and styrene maleic anhydride in a conventional manner. The size pressed substrate has a Tappi brightness of about 85% using Tappi method T-452, a Tappi opacity of about 93% using Tappi method T-425, Sheffield smoothness of about 150 sec, and a Hercules size of 300-500 seconds (10% formic acid).

[0024] The base coating of the present invention comprises essentially pigment and binder. The pigment component is essentially 100% clay and may consist of from about 40-60% kaolin clay and 60-40% calcined clay. In a preferred embodiment, the pigment component comprises a 50/50 mixture of kaolin clay and calcined clay. An example of the kaolin clay useful in the invention is sold under the trademark COVERGLOSS by J. M. Huber corporation. An example of the calcined clay useful in the invention is sold under the trademark ANSILEX BY Engelhard corporation. Both the kaolin clay and calcined clay have an average particle size in the range of from about 0.00495-0.00594 mm (0.5-0.6 micron). The coating binder is preferably polyvinyl acetate, but other binders of the type used in such coatings could be substituted. The solids content of the coating

is preferably less than about 60% at a viscosity of from about 1500-200 mPas (1500-2000 cps Brookfield, No. 2 spindle), for application using conventional coating apparatus on a high speed papermachine. The Gurley porosity of a basestock sample of the present invention is between about 200-800 sec/50 cc. A preferred product would be coated each side with from about 2.72-4.54 kg/278.7m<sup>2</sup> (6-10 lb/ream, ream size 3300 ft<sup>2</sup>).

[0025] As indicated above, the preferred pigment mixture for the present invention comprises about 50 parts kaolin clay and 50 parts calcined clay, where the average particle size of each pigment component is within the same range. This pigment combination provides a generally acceptable basecoat useful with a variety of ink receptive top coats.

[0026] A unique feature of the present invention is the use of calcined clay. Calcined clays are, in general, difficult to work with in paper coatings, and have in the past been best known for use as extenders for titanium dioxide, where the titanium dioxide component of the coating is small. However, calcined clay provides a substantial increase in the porosity of the base coating, particularly within the preferred particle size range of from about 0.00495-0.00594 mm (0.5-0.6 micron), and is a worthy substitute for the precipitated calcium carbonate normally used in such base coatings.

[0027] Calcined clays are well known as conventional coating components for lightweight printing papers and the like, particularly as disclosed in U.S. Patents Nos. 5,152,834 and 5,755,871. The '834 patent discloses a composite pigment comprising weight ratios of from 30:70 to 70:30 of titanium dioxide and calcined clay, and the '871 patent discloses a high brightness coating composition with a major portion of hydrous kaolin clay and a minor portion of a calcined clay where the calcined clay component comprises only about 15-30 dry parts. However, to the best of applicants' knowledge, there is no known use of calcined clays in commercial inkjet printing papers particularly in the elevated amounts used herein. Accordingly, the combination of kaolin clay and calcined clay in a base coating and notably for an inkjet recording cellulosic sheet, in particular paper, as disclosed herein is believed to be novel and unobvious.

[0028] It will be apparent to those skilled in the art that various modifications and variations can be made in the present invention without departing from the scope or spirit thereof as defined in the appended claims. Other embodiments of the invention will be apparent to those skilled in the art from a consideration of the specification and practice of the invention disclosed herein. It is intended that the specification and examples be considered as exemplary only, with the true scope and spirit of the invention being indicated by the following claims.

#### Claims

1. A coating composition which may be used to coat

a surface, preferably at least one surface of a recording sheet, in particular a recording cellulosic or paper sheet, comprising a binder and pigment, characterized in that said pigment comprises a mixture, in weight ratio, of from about 40-60% Kaolin clay and 60-40% calcined clay.

2. The coating composition of claim 1, wherein said pigment is consisting essentially of, or is made only of, the mixture, in weight ratio, of from about 40-60% Kaolin clay and 60-40% calcined clay.
3. The coating composition of claim 1 or 2, wherein each of Kaolin clay and calcined clay has an average particle size in the range of from about 0.00495-0.00594 mm (0.5-0.6 micro-meter).
4. The coating composition of anyone of claims 1 to 3, wherein said composition comprises a solvent, preferably water thereby being an aqueous coating composition.
5. The coating composition of claim 4, wherein said solvent, preferably water, is present in an amount sufficient to provide a coating composition with a solids content of less than about 60% and preferably from about 45 to 60% and advantageously, said coating composition having a viscosity of from about 1500-2000 mPas (1500-2000 cps Brookfield, No.2 spindle).
6. The coating composition of anyone of the preceding claims, wherein the weight ratio of Kaolin clay to calcined clay is about 50/50.
7. The composition of anyone of the claims 1 to 6, wherein said binder comprises polyvinyl acetate.
8. Use of the coating composition as defined in anyone of claims 1 to 7, for coating a surface, preferably at least one surface of a recording sheet, advantageously of a cellulosic, in particular paper, recording sheet, in one or more coating layers, advantageously to form at least a base coat.
9. The use of claim 8, wherein said composition is for forming a base coat of an ink-jet recording sheet, preferably an ink-jet recording cellulosic, in particular paper, sheet comprising a size pressed paper rawstock.
10. A base coated recording sheet, preferably a base coated cellulosic, in particular paper, recording sheet notably for ink-jet recording, having applied to at least one surface thereof the dried residue of from about 2.72 to 4.54 kg/278.7 m<sup>2</sup> (6-10 lbs/ream, ream size 3300ft<sup>2</sup>) of a coating composition as defined in anyone of claims 1 to 7, preferably an aque-

ous coating composition.

11. The coated recording sheet of claim 10, wherein the dried residue of said coating composition provides a Gurley porosity of said recording sheet of from about 200-800 sec/50 cc.

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MEMORANDUM FOR THE DIRECTOR

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## EUROPEAN SEARCH REPORT

Application Number  
EP 00 40 1254

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X, D	US 5 755 871 A (T.E. HUSSON, SR.) 26 May 1998 (1998-05-26) * column 2, line 1 - line 35 * * column 4, line 44 - line 52 * * claim 1 *	1-11	B41M5/00 C09D5/02 C09D131/04 D21H19/40
A	PATENT ABSTRACTS OF JAPAN vol. 1999, no. 09 30 July 1999 (1999-07-30) & JP 11 105204 A (NISSHINBO IND INC), 20 April 1999 (1999-04-20) * abstract *	1-11	
P, A	US 5 997 625 A (M.G. LONDO ET AL.) 7 December 1999 (1999-12-07) * column 1, line 64 - column 2, line 22 * * claims 1, 17 *	1-11	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			B41M C09D D21H C09C D21F B41J
The present search report has been drawn up for all claims			
Place of search <b>THE HAGUE</b>		Date of completion of the search <b>7 August 2001</b>	Examiner <b>Bacon, A</b>
<p><b>CATEGORY OF CITED DOCUMENTS</b></p> <p>X : particularly relevant if taken alone  Y : particularly relevant if combined with another document of the same category  A : technological background  O : non-written disclosure  P : intermediate document</p> <p>T : theory or principle underlying the invention  E : earlier patent document, but published on, or after the filing date  D : document cited in the application  L : document cited for other reasons  &amp; : member of the same patent family, corresponding document</p>			

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**ANNEX TO THE EUROPEAN SEARCH REPORT  
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

07-08-2001

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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